**PML\_V2 evapotranspiration products in Google Earth Engine (GEE)**

Dongdong Kong ([kongdd.sysu@gmail.com](mailto:kongdd.sysu@gmail.com))

# Introduction

Penman-Monteith-Leuning model (abbreviated as PML\_V1) was proposed by Leuning et al. (2008), and further improved by Zhang et al., (2010, 2016). In PML, evaporation is divided into: transpiration from vegetation (Ec), direct evaporation from the soil (Es) and vaporization of intercepted rainfall from vegetation (Ei). PML\_V2 was developed by (Gan et al., 2018), which coupled ET and gross primary products via canopy conductance theory. ***They are both in the resolution of 500m and 8-day, and range from -60°S to 90°N.***

Google Earth Engine (GEE) is a planetary-scale platform for Earth science data and analysis, developed by Google. It has a multi-petabyte catalog of satellite imagery and geospatial dataset with planetary-scale analysis capabilities that are available for scientists, researchers, and developers to detect changes, map trends, and quantify difference on the Earth’s Surface (Gorelick et al., 2017).

**Table 1.** PML\_V2 bands information (PML\_V1 have no GPP band, other bands are some.)

|  |  |  |  |
| --- | --- | --- | --- |
| BandName | Units | Scale | Description |
| GPP | gC m-2 /d | 0.01 | Gross primary product |
| Ec | mm/d | 0.01 | Vegetation transpiration |
| Es | mm/d | 0.01 | Soil evaporation |
| Ei | mm/d | 0.01 | Interception from vegetation canopy |
| ET\_water | mm/d | 0.01 | Water body, snow and ice evaporation. Penman evapotranspiration is regarded as actual evaporation for them. |
| Qc | - | - | Interpolation information for Albedo and Emissivity.  Bitmask for qc:  Bits 0-2: Emissivity interpolation information  0: good value, no interpolation  1: linear interpolation  2: history 8-day average interpolation  3: history monthly average interpolation  Bits 3-5: Albedo interpolation information  Same as Emissivity. |

# Develop PML-V2 in GEE

### Calibrate model parameters in local

1. Fluxnet pre-process, (<https://github.com/kongdd/fluxsites_tidy>)
2. PML-V2 MATLAB version, (<https://gitlab.com/kongdd/PML-V2>)

### Develop PML-V2 in GEE

1. Install gee\_monkey (<https://github.com/kongdd/gee_monkey>)

For the convenience of submit tasks and download data in batch.

1. Accept the sharing PML project if you want to modify it. (<https://code.earthengine.google.com/?accept_repo=users/kongdd/PML>)
2. After calibration in local, translate parameters in JavaScript form and paste into GEE.

<https://github.com/kongdd/fluxsites_tidy/blob/master/R/PML_V2/PML-v2_parameters.R>

### Post-process

1. Access data

Click the following links to get the access to PML\_V2 and PML\_V1 dataset. The corresponding links are:

<https://code.earthengine.google.com/?asset=projects/pml_evapotranspiration/PML/OUTPUT/PML_V2_8day>

<https://code.earthengine.google.com/?asset=projects/pml_evapotranspiration/PML/OUTPUT/PML_V1_8day>

1. Visualize and inspect data in GEE

Spatial distribution, time-series, trend, etc.

1. Data download

PML\_V1 and PML\_V2 products are standard ‘ee.ImageCollection’ object in GEE.

You can clip regional data by polygon shapefile from ‘ee.ImageCollection’.

* Upload your polygon shapefile to GEE (<https://developers.google.com/earth-engine/importing>)
* Clip and export the regional data you need by the polygon shapefile, just like that: <https://code.earthengine.google.com/90572f56835f68c7adaea161c68f9171>, <https://developers.google.com/earth-engine/exporting>

**References:**

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Figure 1. The flowchart of PML\_V2 in GEE